Miscellaneous Notes

1. FURTHER ATTEMPTS TO DETERMINE THE FOOD HABITS OF THE INDIAN RHINOCEROS AT KAZIRANGA

In an earlier communication (Brahmachary *et al.* 1971) the attempt to determine the food habits of the Rhino in Jaldapara, was described. It was concluded that observing the microscopic sections of the vegetal remains in the dung was a good technique, especially for Jaldapara or other similar places where direct observation is difficult due to the nature of the terrain and vegetation.

The present report describes results of a study in Kaziranga during about a fortnight in January, 1972. Unlike at Jaldapara, direct observation at Kaziranga turned out to be very simple because one can approach the rhinos to very close quarters while mounted on elephants and the grass being short in certain seasons, the actual grass species fed on by the rhinos can be noted. Over the years the mahouts have also noticed these grasses and plants so that the food habits are largely known. The following are our findings.

Plants germinated in the dung:

This, according to us, is the most important result of the present study. *Old* dung balls, examined on breaking open, revealed plants germinated inside them. We did not examine the old dung balls in Jaldapara and therefore missed this aspect. At Arimora (Kaziranga) startlingly large numbers of grass stems, producing roots and stems with leaflets at nodes, were found inside the dung balls. We also detected two dicot seedlings. As we were not equipped for carrying these back to Calcutta and cultivating them, we tried to bring only a few packed in a very small tin container and practically none survived the ordeal.

Only one grass stem with leaves, on being transplanted to a pot in Calcutta, grew up to a certain small but detectable size. Although precise identification is not possible under these circumstances, this grass seemed to be almost certainly *Cynodon dactylon*, one of the common lawn grasses. Practically all other grass stems germinated inside the dung balls at Arimora were of a different type. They were certainly of the creeping type and from the description

'rooting at nodes' by Mahanta and Neog (1968) seem to be 'Alaijabari' (*Drymaria cordata*).

The interesting point about this preliminary observation is that this can be developed into a technique for determining the food habits in terrain where direct observation is difficult or impossible for, the plants can be cultivated, locally, in pots or in plots of garden; secondly, the implication points out a new means of dispersal for grass and is therefore of ecological importance. Bor (1960) describes the different mechanisms for dispersal of grass through animal agents but dispersal through alimentation has not been considered probably because the herbivores in general (like cattle or deer) digest the grass thoroughly. The rhino and the elephant pass on large undigested pieces through their alimentary canal and into the dung. We did not find germinating grasses inside the old elephant dung but the large quantities observed in rhino dung effectively prove that this animal plays a role in the dispersal of grass.

Solanum khasianum (Ban-Begun) is often found to grow around rhino dung, as has also been noticed by the local people. We noticed 20 cases of such luxuriant growth of this plant around rhino dung. Not a single case of such growth was found in the few plants we noticed in places where no dung had been excreted. We also assured that the young plant were growing from *inside* the dung ball, and not from the soil below. Birds can also drop the seeds, accidentally, on the fresh dung but this is unlikely in so many instances. The Rhino, therefore, seems to act as an agent for dispersal and concentration of this plant. Apparently, the dung also acts as a source of manure and/or moisture, which in turn may affect the chemical contents of the plant like solasodine (see later).

Direct observation : –

We observed Rhinos feeding voraciously on *Flemingia lineata,* a small shrub. Even plants partially burnt black and apparently totally dry were plentifully eaten. This is the only non-grass species we could directly observe during the actual process of eating. The prehensile upper lip is very handy in manipulating such shrubs and clumps of tall grasses.

The rhinos fed on almost all the grassy growths, the very short grasses creeping on the soil as well as tall grasses from part of their menu. All these grasses can easily be identified if the inflorescence is available.

We could collect inflorescence of the following 11 species while

Mahanta and Neog (loc. cit.) list 26 species of common grasses. Attempts at other seasons, in particular early monsoon, would no doubt be very fruitful for collecting the remainig species:

		local name
1.	*Imperata cylindrica*	ulu
2.	*Eragrostis gangetica*	
3.	*Cyperus rotundus*	
4.	*Vetiveria zizanioides* (see below)	
5.	*Aristida cyanantha*	
6.	*Sporobolus diandra*	
7.	*Chrysopogon aciculatus*	bonguti
8.	*Thysanolaema phragmites*	
9.	*Rhynchospora aurea*	
10.	Unidentified	
11.	*Arundo donax*	Nal

[one of these, locally known as Birina, was identified by the Botanical Survey of India, Culcutta, as *Vetiveria zizaniodies* although according to Mahanta and Neog (loc. cit.) it is *Erianthus elephantius*].

Examination of vegetal remains in the dung:

It is well known at Kaziranga that the rhinos now plentifully eat water-hyacinth. We also detected numerous remains of water-hyacinth strips in various dung balls near the marshy places.

More than 1500 undigested stems were collected from various dung balls but it became soon apparent that the technique of examining the microscopic sections of these remains would be unnecessary in case of the openland rhino at Kaziranga. Unfortunately very few stems in good condition were found in the dung balls collected from the woodland. Of the 12 stems which allowed sectioning only 3 were dicot species.

Chemical studies. (*a*) It is of great interest to study the nutritional and other chemical aspects of the local plants consumed by the wild animals. Apart from the question of wild game management, such studies might lead to the discovery of superior food for domestic livestock and of useful drugs.

Mahanta and Neog (loc. cit.) sum up the data on total nitrogen content, mineral content etc. in some of the commoner grasses of Assam. An important new aspect of study will be the estimation of certain amino-acids like lysine, cystein, methionine etc. Lysine-rich corn or wheat has appeared as a great boon. Harpstead (1971) reviews

the experiments on lysine-rich corn and shows how it may spell the difference between life and death. Leaf protein is however rich in lysine (Pirie 1969) (unlike seeds, grains etc.). Again, in certain grasses, TCA-soluble and TCA-insoluble nitrogen are about equal in amount (Pirie 1971) so that free amino-acids are present in large quantities and are therefore worth estimating.

(*b*) These studies can be carried out only in a local laboratory but we have made some preliminary tests with the leaves of solanum and lawn grass (*Cynodon dactylon*) obtained from the outskirts of Calcutta (which may thus differ from the Kaziranga samples).

One dimensional paper chromatography showed only one or two large free pools of amino-acids in solanum leaves while 5 such pools were traceable in *Cynodon*. With 2-dimensional chromatography, the latter would probably resolve a larger number of amino-acids. None of these amino-acids seemed to coincide with 'marker' lysine.

(*c*) *Remarks:*

Laijabari grass (*Drymaria cordata*) is the richest in calcium of all the Assam grasses which are generally calcium poor (Mahanta & Neog 1968). It is good that rhinos eat this species plentifully.

Water-hyacinth is not a very good food for its dry weight is only about 9-10% and of that about 10% is protein (Matai, pers. comm.). Good grass is preferable to this pestiferous weed.

Cynodon dactylon (dub or lawn grass) can produce HCN (Bor, loc. cit.) under certain conditions of drying so that in certain years, such as of extreme drought, places with extensive growth of this grass should perhaps be burnt off.

Solanum khasianum has gained some reputation as the source of an alkaloid (solasodine) which may act as a precursor of steroid hormones and as such may be of interest as a commercial source for drug manufacturers (Maiti *et al.* 1964; Maiti & Mathew 1967; Saini 1966). As manuring has an influence on the alkaloid content (Biswas, pers. comm.), the vigorously growing plants around the rhino dung are worth studying.

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2. ON THE INCREASING OCCURRENCE OF TYPICALLY PLAINS-BIRDS IN THE KUMAON HILLS

For many years now, I have been bird-watching in the Lake region of Kumaon, comprising the five lakes of Sattal, Naukuchiatal, Bhimtal, Khurpatal and Nainital as well as the surrounding hills. The area under observation extends from 1286 m (4220′) which is the level of the Sattal lakes, to 2591 m (8500′), the height of Cheena Peak above Nainital, and has direct access to the plains by means of several steep river valleys.

In the fifties and early sixties I had made a detailed list of the birds occurring in the area with some notes on distribution, status and habitat, but since 1964 I have been abroad, returning to India about once every two years for a month or two, generally in winter and early spring. During each visit, I have made new entries in my list, of birds not observed before in the area. Surprisingly almost all of the ' new ' birds are typical low-elevation species, no new records of high-elevation species having been made during the same interval. A list of these birds that have now become resident in the area is given below:

1. **Purple Sunbird** *Nectarinia asiatica*. Although this bird is known to ascend to 5000′ in the Himalayas (Whistler 1941) it is mentioned here as its status has changed from that of a scarce summer visitor to a common resident at Bhimtal, 4340′ (1320 m).

2. **Crowpheasant** *Centropus sinensis*. This bird is also known to occur up to 6000′ (1830 m), but whereas it had never been observed in the Lake Region before, a pair have now taken up residence at the headquarters of the Bhimtal lake.

3. **Blackwinged Kite** *Elanus caeruleus*. This is also a low-elevation bird that was only rarely seen before, but now regularly breeds at Bhimtal. It is however, not resident, being only rarely seen in winter.